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FINAL DRAFT Supplemental Investigation Report
Grandview Mine/Mill Site Reconnaissance
Metaline Falls, Washington

prepared by

ENTACT, LLC

On behalf of

Blue Tee Corp., Seattle City Light, Teck Cominco Washington Incorporated, and Washington Resources, LLC

December 2008

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List of Tables

List of Figures

List of Attachments

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1.0 INTRODUCTION

On June 13, 2008, the United States Environmental Protection Agency, Region 10 (U.S. EPA) submitted a General Notice Letter to Blue Tee Corp., Seattle City Light, Teck Cominco Washington Incorporated and Washington Resources, LLC (collectively the Respondents) requesting that the Respondents enter into an Administrative Order on Consent (AOC) to conduct an Engineering Evaluation/Cost Analysis (EE/CA) for the Grandview Mine Site (Site) located in Pend Oreille County, Washington. As summarized below, the Site has been investigated on several occasions by contractors for the U.S EPA and others. Based on review of the results of these previous investigations, a Site visit and conversations with Mr. Earl Liverman of U.S. EPA; the Respondents believed that, with the possible exception of information on other potential mining-related areas of the Site and some additional information on the volumes of previously investigated mining-related source material, no additional information was required to prepare the EE/CA for the Site.

Based on this belief, and after consultation with U.S. EPA, the Respondents retained ENTACT, LLC (ENTACT) to prepare a Work Plan for and to conduct supplemental investigations of the Site to: 1) determine if there were other areas of the Site affected by historic mining or milling operations and 2) better define the nature and extent of all source materials on the Site to support the preparation of the EE/CA.

This report presents the results of the supplemental investigations conducted at the Site by ENTACT during September 15 through 18, 2008. The Supplemental Investigation Work Plan (Work Plan) for the investigations was prepared and emailed to U.S. EPA in September 2008 and a copy of this Work Plan is provided as Attachment 1 to this report.

2.0 BACKGROUND

The Site location and description, as well as a summary of the previous investigations and removal actions performed at the Site, are presented in the following sections.

2.1 Site Location and Description

The Site is an approximate 200 to 300-acre parcel located on Government Lots 9 and 11 in the northwest quarter of Section 22, Township 39 North, Range 43 East in Pend Oreille County, Washington, as designated on the 1992 United States Geological Survey (USGS), 7.5 Minute, Metaline Falls Quadrangle topographic map. The Site is located approximately 0.75 miles from the east bank of the Pend Oreille River, approximately 90 miles northwest of Spokane, and 2 miles northeast of Metaline Falls, Washington, as shown on Figure 1.

The Site is located in the Metaline Mining District ("District"). The District contains low grade lead-zinc ores which were mined from the late 1900s to present time. The Grandview Mine was developed in the late 1920s by Grandview Mines, Inc. and was operated until 1964. After operations were discontinued, most of the mining and milling equipment was removed from the Site, but several buildings associated with former mining and milling operations remain on the

Site. In addition, scattered small accumulations of waste rock or unprocessed ore associated with former mining operations, and flotation tailings associated with former milling operations, are located on the Site.

2.2 Previous Investigations and Removal Actions

In October 2000, Ecology and Environment, Inc. (E&E), under contract to the U.S. EPA, conducted a Preliminary Assessment/Site Investigation (PA/SI) of the Site (E&E, 2001). The PA/SI identified and investigated four distinct areas of the Site – the Upper Level Mine Area, the Lower Level Mill Area, the Drainage Ditch (located below the Lower Level Mill Area), and the Tailings Accumulation Area and down gradient ditch (Figure 2). The Upper Level Mine Area contains a collapsed mine adit and several buildings associated with former underground mining operations. The Lower Level Mill Area contains the ore crushing equipment, the foundations of the former milling facilities, waste rock/unprocessed ore accumulations, and a log cabin currently occupied by the Site caretaker on behalf of Washington Resources, LLC, the current land owner. Tailings from the milling operation appear to have been conveyed via a wooden flume to the Pend Oreille River. Tailings were documented in the Drainage Ditch down gradient of the Lower Level Mill Area, in an approximately 2-acre Tailings Accumulation Area and in a ditch down gradient of the Tailings Accumulation Area. The PA/SI also documented that between 100 and 200 abandoned drums were previously present in the ditch connecting the Lower Level Mill Area and the Tailings Accumulation Area. These drums were removed and disposed of by Washington Resources, LLC between June and December 2000. The drums were disposed of at the Graham Road Disposal Facility located in Medical Lake, Washington.

The PA/SI included the collection and analysis of samples from potential source areas and receptors. Source area sampling addressed the tailings pile, waste rock pile area, and the former wastewater ditch and associated abandoned drum storage area. Based on the results of the 2000 investigation, the on-Site sources contained concentrations of metals, notably arsenic, cadmium, mercury, lead, and zinc that exceeded the Washington State Model Toxics Control Act (MTCA) Method A Soil Cleanup Levels for Industrial Properties and/or the U.S. EPA Region 6 Human Health Medium Specific Screening Levels (HHMSSLs). Several semi-volatile organic compounds were also detected in surface soil samples collected from the abandoned drum storage area. Groundwater and surface water/sediment sampling was also conducted, including sampling of the Pend Oreille River.

In June 2001, E&E collected additional surface water and sediment samples in the Pend Oreille River. Concentrations of metals in surface water and sediment were found to be slightly elevated compared to background (E&E, 2002). In July 2002, the Bureau of Land Management (BLM), U.S. EPA, and E&E, (U.S. EPA START-2 contractor), conducted a visual inspection of the Site and surrounding area. BLM conducted field screening in the Lower Level Mill Area using a field portable X-Ray Fluorescence (XRF) instrument. Locations screened included waste rock areas located west and south of the caretaker's residence and on the west side of a former truck loading shed foundation. XRF results showed lead levels exceeding MTCA Method A Soil Cleanup Levels, and the U.S. EPA Region 6 HHMSSLs.

In August 2003, the U.S. EPA and E&E toured the Site with the Grandview Mine caretaker to measure and take photographs of the tailings deposit, conduct a reconnaissance of the down gradient drainage ditch that begins at the west end of the tailings deposit and ends at the bluff above the Pend Oreille River. No sampling or XRF field screening was conducted. E&E observed deposits of tailings material throughout the length of the down gradient drainage ditch, which varies in width between 1 and 3 feet, up to the edge of the bluff (E&E, 2003).

In August 2007, TechLaw, the U.S. EPA START-3 contractor, performed a Removal Assessment (RA) of the Site to assess the need for conducting removal activities pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). This RA addressed both the Upper Level Mine Area and the Pend Oreille Village, a small residential area located near the Tailings Accumulation Area. This effort included the collection of 121 soil samples from 20 residential lots and 6 surface soil samples from the Upper Level Mine Area. Six residential lots, including the caretaker's residence located in the Lower Level Mill Area, were found to contain soil cadmium and/or lead concentrations exceeding MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses (TechLaw, 2007). The caretaker's residence contained soil lead concentrations exceeding HHMSSLs (TechLaw, 2007). XRF screening was conducted at four locations at the Upper Level Mine Area in the vicinity of the blacksmith/machine shop, magazine area, diamond core storage shack, and electric cars. XRF results showed metal concentrations exceeded the MTCA Method A Soil Cleanup Levels for Industrial Properties (TechLaw, 2007). Analytical results showed that lead, arsenic, cadmium, and methylene chloride exceeded MTCA Method A Soil Cleanup Levels and/or the Region 6 HHMSSL (TechLaw, 2007).

In addition to the above U.S. EPA lead investigations, Teck Cominco American Incorporated retained URS Corporation (URS) to further characterize the tailings at the Tailings Accumulation Area. URS conducted the investigation in September 2006 to define the nature and extent of tailings in the Tailings Accumulation Area (URS, 2007). The investigation included 28 hand-auger soil borings, 15 test pits, and the collection of samples for chemical and geotechnical analysis. The investigation found the Tailings Accumulation Area to contain approximately 20,700 cubic yards (yds^3) of tailings located on 3.1 acres. The *Final Draft Site Characterization Report, Grandview Tailings, Pend Oreille Village, Washington* (URS, 2007) is presented as Attachment 2.

3.0 OBJECTIVES AND SUMMARY OF ACTIVITIES

ENTACT conducted field activities at the Site from September 15 to 18, 2008. There were two main objectives for this supplemental investigation, outlined as follows:

1) To conduct a reconnaissance of the Site to assess other potential areas of source materials/contamination not described in previous reports. This reconnaissance entailed accessing areas outside of the areas of the site identified during previous investigations (the Upper Level Mine Area, Lower Level Mill Area, Drainage Ditch, and Tailings Accumulation Area and down gradient ditch), and noting any signs of mining-related disturbance or source materials.

2) To better define the nature and extent of all source materials on the Site (including any new areas identified during the reconnaissance) to support the preparation of the EE/CA. In order to better define the source materials at the Site, the following activities were conducted:

   - Previously identified source materials located in the Tailings Accumulation Area and down gradient ditch, waste rock piles, and the Drainage Ditch area were measured to determine the volume of the source materials. The vertical limits of the source materials were assessed using hand augers.

   - Areas of the Site outside of the previously identified areas were assessed for potential sources of contamination.

   - Field screening techniques (XRF and Photo-ionization Detector (PID) instruments) were utilized to identify the extent of wastes and contaminated media (e.g., soils) at the potential source areas, including any newly identified areas.

   - Samples of waste and/or soil material were collected for laboratory analysis to confirm field screening results.

The field methodology and investigational findings for the Site Reconnaissance and Source Material Investigation are presented in Sections 4 and 5, respectively.

4.0 SITE RECONNAISSANCE

ENTACT conducted a visual reconnaissance of the Site to assess other potential sources of contamination not described in previous reports. Existing on-Site roadways and utility right-of-ways provided access to the more heavily vegetated/remote portions of the Site. A gravel-covered access road, identified as Grandview Flat Road, provides access to the Lower Level Mill Area from Highway 31 (Figure 2). This road is less than 0.5 miles in length and approximately 25-feet wide (Attachment 3, Photograph 1). Areas to the west and east of Grandview Flat Road were traversed on foot to access portions of the Site not visible from the road. Access roads leading to the Upper Level Mine Area from the Lower Level Mill were traveled by truck for additional reconnaissance of the Lower Level Mill Area and areas surrounding these roads. ENTACT also explored areas along access roads and utility right-of ways in areas south of the Lower Level Mine Area which were accessible on-foot and did not present a safety hazard. The drainage ditch that runs from the Lower Level Mill Area to the Tailings Accumulation Area and a previously undefined ditch in the vicinity of the Tailings Accumulation Area were also inspected as part of the investigation was also inspected as part of the investigation. The Site caretaker was also questioned about historic activities and the presence of any suspect areas. The caretaker accompanied ENTACT in a reconnaissance of an access road leading north from the Upper Level Mine Area to an open pit and an abandoned vertical mine shaft. A 2006 aerial photograph was also referenced to identify suspect areas.

Any suspect soils and/or source materials observed as part of the Site Reconnaissance were sampled using a portable, handheld Innov-X Systems Alpha Series XRF instrument to determine the concentrations of metals to determine if the material sampled possessed characteristics of waste rock and/or tailings. Thirty-one percent of the screening samples were submitted for confirmatory laboratory analysis. Samples collected in the vicinity of the former abandoned drum area were also field screened for the presence of total organic vapors using a MiniRae 2000 PID instrument equipped with a 9.8 electron volt probe. Field measurements were made using a cloth tape, survey wheel, survey rod, a handheld Garmin Geographic Positioning System (GPS) 60CSX instrument, and a Brunton® eclipse® 8099 mirrored sighting compass. These sample collection, field screening, and other data collection activities were conducted in accordance with the methods and procedures specified in the Work Plan (Attachment 1). The quality assurance activities associated with these activities are discussed in Section 6.

4.1 Additional Areas of Potential Concern

The Site Reconnaissance identified three areas of potential concern not identified in previous U.S. EPA investigations. Surficial material in these three areas contained materials with similar characteristics to the tailings observed in the Tailings Accumulation Area, or waste rock observed in the Lower Level Mill Area. All three of these areas are located in the general vicinity of previously investigated Site features. No other additional areas of historic mining or milling activities were discovered on the Site as part of the Site Reconnaissance. These areas of potential concern are described in the following paragraphs and the corresponding sample results are discussed in Section 5.

Historic Homesite Area

The first area of potential concern identified as part of the Site Reconnaissance was located in a reportedly historic housing community (homesite area) located south of the caretaker's residence on the east side of Grandview Flat Road (Attachment 3, Photographs 2 and 3). A 1992 USGS historical topographic map indicates buildings in this area (Figure 1). This area includes an overgrown access road, several concrete foundations and household appliances. According to the caretaker, he burned down three to four homes in the early 1990s. Based on visual observations, it appeared as though waste rock had been used as surfacing materials in the homesite area and samples were collected for analysis. The results of this sampling are presented in Section 5.1.2.

Distressed/Unvegetated Areas West of Grandview Flat Road

The second area of potential concern identified as part of the Site Reconnaissance consisted of distressed and/or unvegetated areas located along the west side of the Grandview Flat Road. These areas, shown on Figures 3 and 4, include a small distressed area located near the Highway 31 entrance and an approximately 0.6-acre unvegetated area located across from the historic homesite area near the Lower Level Mill Area (Attachment 3, Photographs 4 and 5). Based on visual inspection it appeared that tailings or other mining-related materials have been disposed in this location and samples were collected of this material for analysis. The results of this sampling are presented in Section 5.2.1.

Man-Made Ditch

The third and final area of potential concern identified as part of the Site Reconnaissance was a ditch located along the northern portion of the Tailings Accumulation Area. This ditch does not appear to have natural characteristics and is referred to in this report as the Man-Made Ditch. This ditch extends northwesterly from the lower portion of the above Drainage Ditch approximately 770 feet to the top of the Pend Oreille River bluff (Figure 5). A description of this ditch and chemical analysis of the materials in this ditch are provided in Section 5.2.4.

5.0 SOURCE MATERIAL INVESTIGATION

There are two types of source materials that have been identified at the site: waste rock and tailings. The following sections describe the waste rock and tailings observed at the Site and estimated source volumes, including the identified areas of potential concern introduced in Section 4.1. The ENTACT 2008 reconnaissance field screening and laboratory sampling results, as well as relevant historic sampling results, are also discussed in these sections.

5.1 Waste Rock

Waste rock consists of unprocessed mined rock. The rock consists of angular to subangular material ranging from coarse fines to pieces roughly 2 to 3 inches in diameter, possessing an overall light grey coloration. The rock appears to be predominantly fine-grained sedimentary dolomite/limestone.

According to the caretaker, ore was historically transported from the mine on the Upper Level Mine Area to the crusher on an elevated track. At the time of the reconnaissance, foundation structures were observed near the crusher and along the hillside between the Lower Level Mill Area and the Upper Level Mine Area and remnants of electric tram chassis were observed in the Upper Level Mine Area (Figure 6). Accumulations of waste rock were observed in the Lower Level Mill Area and around the electric tram foundations leading from the crusher to the Upper Level Mine Area. In addition, based on visual observations and recorded metals concentrations, waste rock has been used to surface portions of the Upper Level Mine Area, the Lower Level Mill Area, and access roads on the Site.

5.1.1 Lower Level Mill Area

An accumulation of waste rock is located in the northern portion of the Lower Level Mill Area (Figure 6). The majority of the waste rock is located around the ore crusher and on a slope extending 300 feet to the west southwest (for clarification, this accumulation of waste rock will be referenced as the North Pile) (Figure 6). The ore crusher appears to have been constructed on a leveled area, possibly on bedrock, at the base of a bluff that defines the northern limits of the Lower Level Mill Area.

An additional small pile of waste rock is located along the northwest and west sides of the crusher. This pile extends south of the crusher (Figure 6). A natural slope at the base of the bluff, southwest of the crusher, is covered with a relatively thin layer of waste rock (as evidenced by abundant sapling and tree growth on this slope); however, a deeper accumulation of waste rock is located at the western end of this slope. Two other small piles of waste rock are located along the south side of the concrete silo. A fourth, discrete pile is located to the southwest of the silo.

The soils beneath the waste rock were sampled by E&E during the PA/SI performed for U.S. EPA (E&E, 2001). The following ranges of concentrations were reported from the five soil samples collected below the waste rock: arsenic (16.4 to 44.0 milligrams per kilogram (mg/kg)), cadmium (2.8 to 23.3 mg/kg), lead (351 to 4,930 mg/kg), zinc (245 to 7420 mg/kg) and mercury (0.34 to 1.5 mg/kg). The concentrations of all of these metals, except for zinc, are above MTCA Method A cleanup levels for unrestricted land use and/or industrial properties.

ENTACT collected field measurements of the rock piles using 100 foot cloth tapes, a measuring wheel, a Brunton® eclipse® 8099 mirrored sighting compass, and a survey rod. The compass was used to measure slope angles which were then used to calculate approximate elevations. Due to the irregular shape of the North Pile, a grid system was established by laying cloth tapes at ordinal directions from an arbitrary benchmark to assist in the collection of measurement data.

Estimates of the volume of waste rock in the accumulations on the Lower Level Mill Area were calculated based upon these field measurements (Attachment 4). Due to the irregular nature of the North Pile, an AutoCAD program was utilized to calculate its volume. The surface of the waste rock was established using field measurements. The underlying surface was estimated based upon observations of ground surface where waste rock was not present. These measurements were converted to point files which defined the rock surface and the underlying surface; the volume between the two surfaces was then calculated. The volumes for piles located at and west of the concrete silo were estimated by hand calculations. The volume estimates are presented in Attachment 4 and are summarized below:

Waste Pile	Estimated Volume (yds^3)
North Pile	5,570
Silo Piles	160
West Pile	175
Total	**5,905**

The AutoCAD calculated in-place volume for the North Pile was 4,640 yds^3. Due to the method of field measurements and the size of the pile, as well as the assumptions made regarding the elevation of the surface underlying the rock, a 20 percent contingency was applied to the estimated volume, yielding an estimated volume of 5,570 yds^3 (Attachment 4). No contingencies were applied to the estimates of the smaller, discrete piles.

5.1.2 Surfacing Material

During the ENTACT 2008 reconnaissance, 18 grab surface samples and two hand-augered subsurface samples were collected from in and around the Lower Level Mill Area to determine if waste rock materials were used to pave the surface areas and/or access roads. XRF and corresponding laboratory results of surfacing materials collected from the Lower Level Mill Area, the historic homesite area, and the access roads are listed in Table 1.

The surface of the Lower Level Mill Area outside of the footprint of building foundations and the waste rock piles was covered with sparsely vegetated gravel and fines. Six grab samples (LL-27, LL-28, LL-29, LL-30, LL-31, and LL-32) and two hand-augered subsurface samples (LL-27-1.0-2.0' and LL-31-0.5-1.0') were collected in and around the Lower Level Mill Area at the locations shown on Figure 7 to assess whether this material was waste rock.

XRF results show all nine grab samples of surfacing material had lead concentrations that exceeded MTCA Method A industrial cleanup levels. Laboratory analysis of sample LL-27-1.0-2.0'/FD revealed concentrations of lead and cadmium exceeding the MTCA Method A industrial cleanup levels while sample LL-27-1.0-2.0' revealed concentrations of cadmium exceeding MTCA Method A industrial and lead exceeding unrestricted land use cleanup levels. Although XRF results for LL-27-1.0-2.0' are below MTCA Method A cleanup levels, laboratory results for this subsurface sample indicate that waste rock may be present to a depth of 2.0 feet below ground surface (bgs). Laboratory analysis of LL-31-0.5-1.0' revealed no exceedences.

Five samples (LL-02, LL-03, LL-21, LL-22, and LL-23) were collected from the historic homesite area located south of the caretakers' residence to determine if the access road or the area surrounding the foundations were covered with materials associated with historic mining and milling operations. XRF results show samples collected in the vicinity of the historic homesite area (LL-02, LL-21, LL-22, and LL-23) had metals concentrations that exceed MTCA Method A industrial cleanup levels (Table 1). Laboratory analysis of samples LL-03, LL-21, and LL-23 confirmed concentrations of lead and cadmium exceeding the MTCA Method A industrial cleanup levels (Attachment 5). Based on waste rock sampling results presented by E&E in 2001 and visual observations and XRF field screening conducted during the ENTACT 2008 reconnaissance, it is believed that the surfacing material observed in the historic homesite area is waste rock. The extent of this surfacing material is generally limited to the overgrown access road, an isolated area south of the caretaker's residence, and in the immediate vicinity of the foundations.

Seven grab samples were collected from access roads in the vicinity of the Lower Level Mill Area. These included six from in and around Grandview Flat Road (LL-10, LL-11, LL-14, LL-24, LL-25, and LL-26), and one from the access road leading to the Upper Level Mine Area (UL-LL-Access). Sampling locations from the Lower Level Mill Area and along Grandview Flat Road are shown in Figures 3 and 4.

XRF results for samples collected from the Grandview Flat Road (LL-10, LL-25, and LL-26), and the access road to the Upper Level Mine Area (UL-LL-Access) show lead concentrations exceeding MTCA Method A unrestricted land use cleanup levels. Samples LL-11 and LL-24 collected from Grandview Flat Road closest to the Lower Level Mill Area had lead concentrations that exceed MTCA Method A industrial cleanup levels. Laboratory analysis of sample LL-25 and UL-LL-Access revealed concentrations of lead and/or cadmium exceeding the MTCA Method A unrestricted land use cleanup levels. Sample LL-14 had levels below MTCA Method A cleanup levels. Based on waste rock sampling results presented by E&E in 2001 and visual observations and XRF field screening conducted during the ENTACT 2008 reconnaissance, it is believed that the Lower Level Mill Area and the access road to the Site have historically been surfaced with waste rock.

Four surface grab samples collected from the Upper Level Mine Area by TechLaw in 2007 were found to contain arsenic, cadmium, and lead concentrations that exceed MTCA Method A Soil Cleanup Levels (TechLaw, 2007). No additional sampling was conducted at the Upper Level Mine Area during the ENTACT 2008 reconnaissance, as previous results already indicate the area was surfaced with mining-related material One hand auger was advanced in an area west of the diamond core shack to determine the material thickness. Gravel-sized material was encountered up to 2 feet prohibiting further advancement of the boring indicating that the thickness of the material is at least 2 feet.

Estimates of the volume of these surfacing materials (Attachment 4) were calculated based upon the field measurements described above. The volume estimates are summarized below:

Area	Estimated Volume (yds^3)
Lower Level Mill Area	2,935
Historic Homesite Area	890
Grandview Flat and Upper Level Access Roads	2,490
Total	**6,315**

5.2 Tailings

The tailings observed at the Site consisted of a light grey, friable powder material. Tailings were generally visibly distinct from native soil materials which varied from light yellow to light brown sands and sand loams. Marginal areas around accumulations of tailings where the tailings had apparently inter-mixed with native soils were more difficult to visually differentiate. XRF screening was utilized to assess if soils were potentially affected by tailings. Tailings were found in the area West of Grandview Flat Road, the drainage ditch that extends from the Lower Level Mill Area, the Tailings Accumulation Area and down gradient ditch, and the Man-Made Ditch.

Twenty-two grab samples and four hand-augered samples were collected from areas observed to contain suspected tailings material located in the distressed and/or unvegetated areas, the drainage ditch, and the Man-Made Ditch. XRF and corresponding laboratory results of materials collected from these areas are provided in Table 2.

Based on URS sampling results from the Tailings Accumulation Area (URS, 2007), visual observations and XRF field screening conducted during the ENTACT 2008 reconnaissance confirmed that materials sampled in the distressed/unvegetated areas and the ditches had similar characteristics to tailings associated with historic mining/milling operations.

5.2.1 Distressed/Unvegetated Areas West of Grandview Flat Road

The approximate 0.6-acre unvegetated area was observed along the west side of Grandview Flat Road, roughly 150 feet southwest of the caretaker's property. Surficial material was observed to be a fine, gray silt indicative of tailings (Attachment 3, Photographs 4 and 5). Fifteen grab samples (LL-04 to LL-09, LL-12, LL-13, LL-15 to LL-20 and LL-33) and one hand-augered subsurface sample (LL-05-0-0.5') were collected in and around the 0.6-acre unvegetated area to determine the extent of potential contamination (Figure 3).

Eight of the 15 grab samples field screened with the XRF instrument had metal concentrations that exceed MTCA Method A industrial cleanup levels (Table 2). Laboratory analysis of sample LL-04 revealed metal concentrations exceeding MTCA Method A cleanup levels (Attachment 5).

One hand-auger was advanced at LL-05 to determine the depth of suspected tailings. Observations indicate that the suspected tailings material consisted of a thin layer approximately one inch deep.

XRF results for soils collected at six inches (LL-05-0-0.5') show concentrations of metals below MTCA Method A cleanup levels. Laboratory analysis of LL-05-0-0.5' revealed concentrations for cadmium exceeding Method A industrial cleanup levels. Although materials were observed to be present in a thin veneer, laboratory results indicate that affected soils may extend to 6 inches bgs.

Six grab samples were collected from the surrounding vegetated areas to determine the extent of potential contamination from the unvegetated area. XRF results for grab samples collected at the boundaries of the unvegetated area (LL-13, LL-15, LL-16, LL-19, LL-20, and LL-33) revealed lead concentrations below MTCA Method A cleanup levels. Laboratory analysis of sample LL-13 revealed concentrations of cadmium above MTCA Method A unrestricted land use cleanup levels.

Based upon field measurements, the volume of suspect tailings and associated affected soils in this area was estimated at 640 yds^3. The basis of this volume estimate is presented in Attachment 4.

The distressed area located roughly 400 feet north of the Highway 31 entrance was approximately 450 square feet in size. One grab sample (LL-01) was collected from the area to determine if observed materials had similar characteristics to tailings associated with historic mining/milling operations (Figure 4). XRF results show concentrations of lead that exceed MTCA Method A unrestricted land use cleanup levels (Table 2).

5.2.2 Drainage Ditch

The drainage ditch extends 1,150 feet from the southwestern portion of the Lower Level Mill Area in a general west-southwesterly direction to the Tailings Accumulation Area (Figure 2).

According to the 1992 USGS topographic map, there is a 200-foot drop in elevation between the Lower Level Mill Area and the Tailings Accumulation Area. E&E reported in the 2001 PA/SI that the Site discharged tailings from the floatation process to the Pend Oreille River via a wooden flume (Neale, 1962). Remnants of the wooden flume were observed at the western edge of the ditch at the mouth of the Tailings Accumulation Area (Attachment 3, Photograph 6). Accumulations of tailings observed throughout this ditch may have resulted from spillage over the wooden flume that may have spanned the length of this ditch. Although considerable information was collected by E&E on the tailings in this drainage ditch, ENTACT investigated this ditch further to get information necessary to estimate the volume of tailings in the ditch. For purposes of estimating volumes, the drainage ditch was divided into four sections, referenced as the upper section, mid section, lower mid section, and lower section.

The upper section extends from the Change Room to a point approximately 570 feet downgradient from the Change Room. The former drum storage area was located within this section of the ditch, roughly 50 to 100 feet down gradient from the Change Room (Figures 6 and 7). Three screening soil samples were collected from this section of the ditch, LL-34, LL-35, and LL-36 (Figure 7). The depth of tailings at LL-36 was measured at 2.7 feet; no visible tailings were encountered at LL-34 or LL-35.

XRF screening showed lead levels exceeding MTCA Method A industrial cleanup levels in all three samples, and cadmium exceeding MTCA Method A industrial cleanup levels in LL-35 (Table 1). Because these samples were retrieved from the former drum storage area where earlier investigations had detected organic contaminants, these samples were also screened for total organic vapors using the PID instrument. PID screening of these samples yielded results between 1.0 and 3.2 parts per million total detectable organic vapors (ppmV).

The mid-section of the drainage ditch extends from approximately 570 feet to 800 feet downgradient from the Change Room. This section possesses a severe slope. Soil samples were collected along a transect extending on either side of the ditch at a point approximately 630 feet down-gradient of the Change Room.

XRF screening of samples TP-D-500, collected from the ditch channel, and TP-D-500-S-48', collected 48 feet south of the ditch channel, contained lead concentrations exceeding MTCA Method A industrial cleanup levels (Table 2). Laboratory analysis of sample TP-D-500-48' revealed concentrations of lead and cadmium exceeding the MTCA Method A industrial cleanup levels. XRF screening of samples TP-D-500-N-37', collected 37 feet north of the ditch channel, and TP-D-500-S-88', collected 88 feet south of the ditch channel at the base of a small, 20-foot-high vertical rise, revealed concentrations of lead exceeding MTCA Method A unrestricted land use cleanup levels. Laboratory analyses of sample TP-D-500-S-88' revealed concentrations of lead and cadmium exceeding the MTCA Method A unrestricted land use cleanup levels.

ENTACT investigated soils located atop the vertical rise and confirmed that an isolated area (approximately 2 square feet) of visible tailings was present. One grab sample (TP-500-Bluff) was collected from the suspected material.

XRF screening of TP-D-500-Bluff revealed that the sample also contained lead concentrations exceeding the MTCA Method A unrestricted land use cleanup levels (Table 2). Laboratory analysis yielded both lead and cadmium concentrations exceeding their MTCA Method A unrestricted land use cleanup levels (Attachment 5). The sampling suggests that tailings have migrated well outside of the ditch channel in this section, particularly to the south.

The lower mid section of the ditch, extending from 800 feet to 1085 feet down gradient of the Change Room resumes a less severe slope, and regains some distinct side sloping. The width of the ditch channel measured 17 feet along the somewhat flat bottom, and roughly 50 feet across the top. Surficial tailings are evident in the channel. Based upon topography and the sampling conducted in the mid section, it has been assumed that tailings have spread outside of this channel, particularly on the south side.

The lower section of the ditch consists of an eroded channel through an accumulation of tailings bordering the eastern side of the Tailings Accumulation Area. The depth of these tailings was measured at 8 feet near the mouth of the ditch at the Tailings Accumulation Area.

The estimated, in-place volume of tailings and associated impacted soils (Attachment 4) exceeding MTCA Method A cleanup levels present in the Drainage Ditch is 6,580 yds^3. These volume estimates are summarized below.

Drainage Ditch Section	Estimated Volume (yds^3)
Upper Section	1,600
Mid Section	2,555
Lower Mid Section	1,270
Lower Section	1,155
Total	**6,580**

5.2.3 Tailings Accumulation Area and Down Gradient Ditch

The Tailings Accumulation Area lies at the terminus of the Drainage Ditch, near the Pend Oreille Village. It consists of an approximate 2-acre area of exposed tailings possessing sparse to no vegetative cover (Figure 5). The western boundary of these exposed tailings is roughly delineated by a fence with an access gate near the southern corner. The area west of this fence is heavily vegetated, and also possesses some tailings.

The area of exposed tailings was measured to be approximately 360 feet along a northeast-southwest axis, and approximately 260 feet along a northwest-southeast axis. The majority of the Tailings Accumulation Area is relatively flat; however, a "bench" of accumulated tailings exists in the eastern portion of the pile, where the Drainage Ditch connects with the Tailings Accumulation Area. The top of this bench is an average of 8.7 feet above the lower level of the tailings. Three hand augers were advanced in the lower level of the tailings pile to assess the depth of tailings in this area. The average depth of tailings in this area was approximately 3.8 feet. ENTACT estimated that the Tailings Accumulation Area contained approximately 18,000 yds^3 of tailings (Attachment 4).

A drainage ditch extends from the western corner of the Tailings Accumulation Area and proceeds west and down-gradient to the bluff of the Pend Oreille River. The total length of this ditch is approximately 300 feet. Based on hand augering conducted in this ditch, tailings were present in the main channel to depths of 0.5 to 2.0 feet. Visible tailings were observed extending approximately 55 feet perpendicular to this ditch. ENTACT estimated that this channel contained approximately 915 yds^3 of tailings (Attachment 4).

ENTACT reviewed the Final Draft Site Characterization Report prepared by URS in January 2007 (Attachment 2). URS estimated that the main tailings area covered a total of 3.1 acres and contained a total of 20,700 yds^3 of tailings (URS, 2007). It is noted that a portion of what URS has described as the "main tailings area" appears to include most of the down-gradient drainage ditch. The URS study entailed a GPS survey, in addition to several intrusive test pits and hand augers, as the basis for estimating the volumes of tailings in this area. The limited field measurements collected by ENTACT support the data presented by URS.

5.2.4 Man-Made Ditch

Another drainage ditch was observed to run along the northern portion of the Tailings Accumulation Area. This ditch does not appear to be natural and is referred to as the Man-Made Ditch. This section of the ditch is approximately 10 feet in width and possesses localized accumulations of visible tailings at the surface. Sample TP-SD-01, collected from the ditch at a point 590 feet down-gradient from the point of origin, yielded results exceeding MTCA Method A industrial cleanup levels (Table 2). Laboratory analysis of this sample confirmed concentrations of both lead and cadmium in excess of the MTCA Method A industrial cleanup levels. The depth of visible tailings at this location was 10 inches. Near this point, visible tailings were observed to have breached the ditch channel and flowed towards the Tailings Accumulation Area. It is assumed that wash out from the Man-Made Ditch has resulted in impacts to the soils on the slope between it and the Tailings Accumulation Area.

Immediately west of TP-SD-01, the Man-Made Ditch extends to the northwest away from the Tailings Accumulation Area through a wooded area to the edge of the bluff over the Pend Oreille River. This section of the Man-Made Ditch consists of a well-defined channel measuring between 20 and 30 feet across. Again, localized accumulations of visible tailings are present throughout this section of the ditch. At the edge of the bluff, two samples were collected; TP-SD-02 in the center of the channel, and TP-SD-03, 28 feet outside of the main channel in a wooded slope north of the ditch.

XRF screening revealed lead exceeding MTCA Method A unrestricted land use cleanup levels (Table 2). Laboratory analysis of both samples revealed concentrations of cadmium in excess of the MTCA Method A industrial cleanup levels, and concentrations of lead in excess of the MTCA Method A unrestricted land use cleanup levels.

The estimated, in-place volume of tailings and associated impacted soils (Attachment 4) exceeding MTCA Method A cleanup levels present in the Man-Made Ditch is 1,155 yds^3. These volume estimates are presented in Attachment 4, and summarized below.

Man-Made Ditch Section	Estimated Volume (yds^3)
Upper Section	220
Between Upper Section and Tailings Accumulation Area	435
Lower Section	500
Total	**1,155**

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) data are necessary to determine precision and accuracy and to demonstrate the absence of interferences or contamination of the sampling equipment, glassware, and reagents. This section describes the QA/QC measures taken for the 2008 reconnaissance field activities and sampling and provides an evaluation of the usability of the data presented in this report. The information is presented in two main sections: Field Data QA/QC (Section 6.1) and Laboratory Data QA/QC (Section 6.2).

6.1 Field Data Quality Assurance/Quality Control

Specific quality control procedures and protocols were utilized to assess the quality of the field data collected during this investigation. The specific field data included:

- Field measurements from which volume and extent estimates were derived
- Sample collection and handling for field screening and potential laboratory analysis
- Collection of XRF and PID screening data.

The field procedures and protocol, as well as an evaluation of the field QA/QC data (rinsate blanks and field duplicate samples), are summarized in the following subsections.

6.1.1 Field Measurements for Volume Estimation

The objective for this activity was to collect field measurements of sufficient quality to generate estimates of the lateral and vertical extent of source materials and associated soils exceeding the clean-up objectives specified in the Work Plan. Field measurements were assessed throughout the field effort to ensure completeness. Preliminary mapping of more complex areas was performed at the conclusion of each day's field efforts to assess the completeness of the data set to support the volume estimation task. Field measurements were taken with hand held equipment as specified in the Work Plan and are considered sufficiently accurate to support the volume estimates provided. The precision of field measurements was assessed by taking random duplicate measurements. Select field measurements were also validated against aerial photography of the Site of known scale.

6.1.2 Sample Collection and Handling

The objective for this activity was to collect samples of suspect tailings and soils of sufficient quality to generally define the extent of source materials and associated soils exceeding the clean-up criteria specified in the Work Plan.

Samples of soils and suspect tailings were collected in sufficient quantity to define lateral and vertical extent; estimates of extent were also augmented with field measurements of visible source areas, and observations of topography and drainage patterns within the affected areas. The sample location measurement was taken with hand held equipment as specified in the Work Plan. All locations were recorded using the GPS unit. In some instances, field measurements (e.g., cloth tapes) were utilized to provide additional location data. Locations were also documented in field logs. Select field measurements were validated against aerial photography of the Site of known scale.

Samples of suspect tailings and soils were collected in accordance with the Work Plan. Sampled material was placed in pre-labeled, one-quart re-sealable baggies and fully homogenized by shaking/mixing the contents of the bag. The samples were then immediately field screened after homogenization (refer to Subsection 6.1.3) and stored in an iced cooler placed in a secure location pending selection, re-packaging and transport for laboratory analysis.

All non-disposable sampling equipment, including hand augers and trowels, were decontaminated in accordance with the Work Plan prior to sampling. Decontamination entailed removing all visible dirt and debris, washing with Alconox detergent and potable water, rinsing with distilled water and re-rinsing with distilled water.

Samples selected for laboratory analyses were transferred to pre-labeled 8-ounce glass containers provided by the laboratory. Labeling information on the bag sample and the container was double-checked at the time of transfer; this data was transcribed on a chain-of-custody form at the same time to ensure accuracy. All samples were delivered by the sample team to the laboratory in iced coolers, under chain-of-custody. Field duplicate samples were collected from the same bag sample, transferring materials directly into two separate glass sample containers. All samples submitted to the laboratory were recorded on tri-copy chain of custody forms. One copy was retained in the field files and the other two submitted to the laboratory. Copies of all chain-of-custody forms are included with the laboratory analytical data reports.

To assess the potential for cross-contamination, two rinsate blanks were collected for subsequent laboratory analyses. In addition, two field duplicate samples were collected for laboratory analyses.

6.1.2.1 Rinsate Blanks

Two rinsate blanks were collected in accordance with the Work Plan by pouring distilled water over a freshly decontaminated piece of equipment and collecting the rinsate in a pre-labeled laboratory prepared container. The rinsate was then immediately preserved by the addition of a pre-measured vial of nitric acid also provided by the laboratory. Sample identification followed the approved Work Plan. The results of these analyses are summarized below:

Analyte	RB-001 09/16/08 hand trowels (mg/L)	RB-002 09/18/08 hand auger (mg/L)
Arsenic	<0.0200	<0.0200
Cadmium	<0.00200	<0.00200
Lead	<0.0300	<0.0300
Mercury	<0.000200	<0.000200
Zinc	0.0296	<0.0100

Zinc was detected in rinsate blank RB-01 at an extremely low concentration (0.0296 mg/L). This low concentration is considered insignificant relative to the concentrations of zinc detected by both XRF field screening and confirmatory laboratory analyses, and is not considered to affect the quality of the sampling data.

6.1.2.2 Field Duplicates

From the 15 investigative soil samples collected, a total of two field duplicates were collected. This meets the minimum 10 percent rate for field duplicate collection specified in the Work Plan. At each selected field duplicate sample location, an extra volume of material was collected. Sample identification followed the approved Work Plan with the field duplicate sample identified by the addition of a "FD" at the end of the investigative sample ID. The samples were submitted to the laboratory with an "FD" added to the associated sample identification and were recorded on tri-copy chain-of-custody forms.

A comparison of the investigative sample and field duplicate sample results, including a calculation of the relative percent difference (RPD) between each result, is summarized below:

Analyte	TP-SD-01-0-0.5	TP-SD-01-0-0.5-FD	RPD
Arsenic	11.6	12.5	7.5
Cadmium	14.5	15.4	6.0
Lead	1,070	1,110	3.7
Mercury	0.436	0.46	5.4
Zinc	3,150	3,310	5.0

Analyte	LL-27-1.0-2.0	LL-27-1.0-2.0-FD	RPD
Arsenic	6.94	7.73	10.8
Cadmium	17.4	14.8	16.1
Lead	941	1,370	37.1
Mercury	0.274	0.256	6.8
Zinc	10,100	9,180	9.5

U.S. EPA currently does not have review criteria for determining comparability of field duplicate analyses. Assessment of the adequacy of field duplicate recoveries, particularly for solid matrices such as soils, is deferred to professional judgment (U.S. EPA, 2004). As a point of reference, under the U.S. EPA Contract Laboratory Program, the acceptable limit for RPD in laboratory duplicate and matrix spike duplicate recoveries is 20 percent for aqueous samples.

RPDs for sample TP-SD-01-0-0.5 and its duplicate were all very low, below 10 percent, indicating a low level of sample heterogeneity as well as an acceptable level of both field and laboratory precision. With the exception of lead, RPDs for analytes in sample LL-27-1.0-2.0 and its duplicate were also low, ranging from 6.8 to 16.1 percent. The higher RPD for lead (37%) may be indicative of a higher level of heterogeneity of this analyte within the sample matrix, or is a reflection of precision variability in the analytical procedure, or both.

Overall, the field duplicate results compare very well with the investigative sample results and indicate an acceptable level of both field and laboratory precision.

6.1.3 Field Screening

The completeness of field screening was assessed throughout the field effort. Screening logs were checked against sample collection information to assure that all samples were screened using the XRF. PID screening was specifically limited to samples collected in the former drum handling area within the upper reach of the Drainage Ditch. Field screening instruments were calibrated and operated in accordance with manufacturers specifications and the Work Plan (refer to Subsection 6.1.3.1). A statistical comparison of the XRF results and comparable laboratory data was conducted to assess the precision of the XRF data (refer to Subsection 6.1.3.2).

6.1.3.1 Field Instrument Calibration and Data Recording

The PID and XRF used during this project required regular calibration. Both the PID and the XRF were calibrated with the manufacturer's standards. Instrument calibration data was maintained in the XRF sampling journal. Records produced were reviewed, maintained, and filed by the field operator. The instruments were inspected regularly to ensure that the items met and performed to manufacturer's specifications and project specifications. All field equipment was calibrated in accordance with the specific field Standard Operating Procedures. All XRF sample results were recorded both electronically by the instrument and hand-recorded in the field logbook by the XRF operator. These data were cross-referenced to ensure accuracy.

6.1.3.2 XRF and Laboratory Data Correlation

The XRF was utilized to provide real-time data on the distribution and relative levels of mine-related heavy metals at the Site. XRF results from certain of the metals, specifically lead and zinc, proved more useful in meeting this objective. The sensitivity of the instrument varies from metal to metal, and certain metals will interfere with the accurate detection of others (e.g., the presence of lead will interfere with the accurate detection of arsenic; however the reciprocal is not true). The XRF screening revealed detectable concentrations of lead and zinc in 100 percent (%) of the 48 samples screened. Cadmium was detected in 22.9 % (11 of 48), arsenic in 14.6 % (7 of 48), and mercury in 0 % (0 of 48) of the screened samples.

Selected soil samples were analyzed for total concentrations of the heavy metals to verify the field screening results. The level of correlation between the XRF screening data and the laboratory data was assessed by calculating the Pearson Product Moment Correlation Coefficient [r] for the lead and zinc data sets. The value r provides a measure of linear correlation between sets of paired data. Values of r can range between -1.0, where data shows perfect negative linear correlation, to +1.0, where data shows perfect positive linear correlation. An r value of 0.0 indicates the data shows no correlation.

The value r calculated between the XRF and corresponding laboratory data for lead was 0.968. The value r calculated between the XRF and corresponding laboratory data for zinc was 0.999. These indicate a very strong linear correlation between the XRF field data and the corresponding laboratory data. Calculations of the value of r are presented in Attachment 6.

The dataset for lead suggests that, on average, the XRF will provide a value somewhat larger than the corresponding laboratory value, as indicated by a slope value (m) of less the 1.0 (m = 0.783). A notable exception was sample LL-27-1.0-2.0', where the XRF value significantly underestimated the laboratory value.

The data set for zinc also suggests that, on average, the XRF will provide a value larger than the corresponding laboratory value, as indicated by a slope value (m) considerably less the 1.0 (m=0.464) . However, one of the zinc data points, sample LL-04, appears to be an outlier from the remaining data set. To assess the relationship of the dataset without this outlier, the value r, slope and intercept were re-calculated for the zinc data without using the LL-04 data. These data show a slightly lower r value of 0.897; nonetheless this still suggests a strong linear correlation. The calculated slope (m = 0.909) indicates a near 1:1 relationship between the XRF and the laboratory data without this outlier sample.

This analysis indicates that the XRF data are, in general, a very good predictor of laboratory data for both lead and zinc.

Because of the sensitivity of the instrument, XRF field data does not provide a good direct prediction of concentrations of other heavy metals; specifically, arsenic, cadmium and mercury, at concentrations of potential concern. Based upon the laboratory data, samples with concentrations of arsenic, cadmium and/or mercury that exceeding their MTCA Method A cleanup objectives tended to also have concentrations of lead that also exceeded MTCA Method A cleanup criteria. In sample LL-13, the concentration of cadmium exceed the MTCA Method A cleanup criteria for Unrestricted Land Use, and the concentration of lead did not exceed its MTCA level A clean up criteria. However, the laboratory data exhibit a very strong linear correlation between concentrations of zinc and associated concentrations of arsenic, cadmium and mercury (calculated r values ranged between 0.995 for zinc and mercury to 0.9947 for zinc and arsenic). Upon generating a broader dataset of XRF and analytical data, it may be possible to use XRF concentrations of zinc as a predictor of these other heavy metals by applying multiple regression analysis.

6.2 Laboratory Data Quality Assurance/Quality Control

The project laboratory utilized for this investigation was the Test America laboratory located in Spokane, Washington. Analyses of samples sent to the project laboratory were performed in conformance with the analytical procedures and methods established in the Work Plan, and by reference, with the specific U.S. EPA methods and procedures cited therein.

Upon receipt of the analytical report, the data package was reviewed for completeness and overall data quality. All samples were analyzed within the required holding times. The laboratory data are considered acceptable for use.

Laboratory QA samples were analyzed for both solid and aqueous matrix batches; the QA source samples for duplicate, MS, and MSD analyses for both matrices were obtained from the project samples (samples LL-03 and RB-01 for solid and aqueous batches, respectively).

The laboratory blank samples yielded no detectable analytes. The percent recovery (%R) for the laboratory control sample were all within acceptable limits. RPD for the laboratory duplicate and the matrix spike duplicate were all within acceptable limits within the solid matrix batch. The RPD for lead in the aqueous batch duplicate slightly exceeded acceptable control limits and was flagged by the laboratory.

Within the solid matrix QA batch, the MS and MSD %R for cadmium and arsenic are within acceptable limits. The %R for mercury was slightly outside acceptable limits, and the %R for lead and zinc were well outside acceptable limits. These %R results were flagged by the laboratory as follows: "*Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).*" Because the sample concentration was greater than four times the spike amount, these %R exceedences do not require the associated data to be qualified (U.S. EPA, 2004). As noted, the source sample for the MS/MSD analyses was sample LL-03, which possessed elevated concentrations of both zinc and lead as compared to the spike concentrations. Again, the %R within the LCS sample was within acceptable control limits. The %R for the aqueous batch were all within acceptable limits.

7.0 SUMMARY AND CONCLUSIONS

ENTACT performed a supplemental investigation at the Site to support the preparation of the EE/CA in anticipation of conducting a non-time critical Removal Action. This supplemental investigation included a Site reconnaissance to assess other potential areas of source materials/contamination not described in previous U.S. EPA reports, and collection of field measurements and samples for field screening and laboratory analysis to better define the nature and extent of existing source materials, including any newly identified areas.

Results of the Site reconnaissance revealed three areas of additional potential concern not identified in previous U.S. EPA investigations. These include the Historic Homesite Area, the Distressed/Unvegetated Areas west of Grandview Flat Road, and the Man-Made Ditch. Based on visual observations, it appeared that waste rock has been used as surfacing materials in the Homesite Area; tailings or other mining-related materials have been disposed in the

Distressed/Unvegetated Areas; and the Man-Made Ditch possesses localized accumulations of visible tailings at the surface. Field screening and laboratory analyses of samples of these materials have confirmed the presence of contaminants above soil cleanup criteria. In addition, estimated volumes of identified source materials and associated impacted soils have been generated using field measurements collected during the investigation.

This supplemental investigation, in conjunction with previous investigation results, defines the nature and extent of source materials and related impacted soils in adequate detail to support the preparation of an EE/CA for the Site.

8.0 REFERENCES

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